

## **629 IMPACT ATTENUATORS**

### **629.01 DESCRIPTION**

This work consists of furnishing, assembling and installing permanent impact attenuators at high hazard locations as part of highway and bridge transportation projects. Also included is replacement or refurbishment of damaged existing attenuator installations in the annual attenuator repair project. The attenuator units shall be furnished in the type and size specified and in the locations as shown in the contract documents. They shall be installed according to the manufacturer's recommendations and fully functional.

### **629.02 SAND-FILLED MODULE IMPACT ATTENUATOR**

**(A) GENERAL** - Work consists of furnishing and installing permanent attenuators of the frangible sand-filled inertial module type to construct arrays at new locations as shown on the contract plans, or restore damaged arrays at designated existing locations where vehicle impacts have occurred.

**(B) MATERIALS** - Each module shall consist of an outer container, inner core, lid and sand.

(1) Outer containers, inner cores and lids shall be an approved type. Outer containers shall be yellow in color.

(2) Sand shall conform to 804.02(A), dried to contain not more than one (1) percent moisture by weight. Sand shall also contain 5% sodium chloride by weight.

**(C) INSTALLATION PROCEDURES** - Sand modules shall be installed in accordance with the following procedures:

(1) New Locations - The modules shall be placed on a concrete or asphalt pad or roadway pavement in the configuration as shown on the contract plans. Care shall be taken to ensure that the modules are placed in the specified sizes containing the proper weight of sand. Prior to placement, circles shall be painted on the pad in the proper location with the specified weight of sand indicated in pounds.

(2) Existing Locations - In attenuator repair contracts, sand modules shall be replaced in existing installations as they are damaged by vehicle impact. Within 48 hours of notification by the Engineer, the Contractor shall commence operations for restoration of the site. The Contractor will be provided with a sketch of the site showing the number and orientation of the modules and weight of sand in each module. Prior to beginning work, the contractor shall photograph the damaged array to verify the condition.

The Contractor shall remove all damaged modules, dirt, debris and sand in the immediate area and dispose of these properly. Sand may be salvaged and reused if it meets the requirements of (B)(2) above. Undamaged elements may be reused for temporary locations. Reusable lids shall be used to replace missing lids on existing modules. New modules shall be installed per manufacturer's recommended procedures. To insure that installations are restored as soon as possible, the contractor shall maintain an adequate supply of materials on hand. Unused modules and lids remaining at the end of the contract will be purchased from the contractor under the terms describe in PAYMENT.

**(D) MEASURE AND PAYMENT** - The unit of measure will be per each. The total will be the number of new modules installed in new permanent locations and/or used to replace damaged modules in existing installations.

Payment for this item will be made at the contract unit price per each, which payment will include furnishing and installing new modules, removal and disposal of damaged modules, dirt, debris, and sand

and all labor, tools, equipment and incidentals required to complete the specified work.

In replacement contracts, unused modules remaining after the conclusion of the project will be purchased from the contractor under the terms in PAYMENT. Unused and undamaged modules paid for under this item will become the property of the District and be delivered to a designated storage yard. Installation of reusable lids is considered to be incidental work and allowances should be made when preparing bid price for sand modules.

### **629.03 THRIE BEAM IMPACT ATTENUATOR**

**(A) GENERAL.** Work under this item consists of furnishing, assembling and installing vehicular impact attenuators in the size specified in the contract specifications, complete and in place as detailed and at the locations shown on the contract drawings as per the manufacturer's specifications.

#### **(B) MATERIALS.**

**(1) Energy-Absorbing Cartridge** - The Hex-Foam material shall consist of 28 -One (1) inch thick pieces of a paper honeycomb material placed in an alternating cross-ply orientation. The honeycomb material shall have polyurethane foam filling within the honeycomb volume.

The cartridge box shall be manufactured from cross-linked polyurethane plastic with an average wall thickness of 0.080 inches. The bottom lid of the box shall be stapled in place with galvanized W18- 1/2" staples. Handles shall be mechanically fastened on each end of the cartridge box. The Hex-Foam material inside the box shall be protected by a polyurethane bag and a woven debris containment bag.

**(2) Diaphragms** - The diaphragms shall be made from standard 10 gauge triple corrugated beam. Two support legs made from 2 1/2 inch diameter pipes shall extend from the bottom of each diaphragm to support the unit. Ski-shaped plates shall be welded to the bottom of the support legs. After fabrication, the diaphragms shall be hot dip galvanized in accordance with AASHTO M 111.

**(3) Thrie-Beam Panels** - Panels shall be 10 gauge galvanized steel thrie beam guiderail sections bolted at their front ends to each side of the diaphragms. The rear ends shall overlap the side panels of the following bay and shall be attached in such a way that it telescopes freely when the unit is impacted head-on.

**(4) Nose Wrap** - The nose wrap shall be made of cross-linked, high density polyethylene molded to match the thrie beam. It shall offer substantial yielding yet possess strong ability to recover to its original moulded shape.

**(5) Backup Structure** - All metal shall be AASHTO M 183 unless otherwise specified and galvanized per AASHTO M 111.

**(6) Hazard Marker** - A hazard marker shall be wrapped around and securely attached to the nose of the attenuator facing oncoming traffic. The material shall be 0.025 gauge aluminum sheet and the legend shall be made from Type III High Intensity Reflective Sheeting.

**(C) CONSTRUCTION REQUIREMENTS.** Installation of the attenuator shall be accomplished by the Contractor with experienced workers in accordance with the recommendations of the manufacturer.

**(D) SHOP DRAWINGS.** Before fabricating the unit, shop drawings shall be submitted for approval by the Engineer.

**(E) MEASURE AND PAYMENT.** The unit of measure for these items will be per each unit

installed, complete and in place. Payment for THRIE BEAM IMPACT ATTENUATOR will be made at the contract unit price per each, which payment will include fabricating, furnishing, assembling and installing the units and all labor, tools, materials, equipment and incidentals needed to complete the specified work.

## **629.04 HEX-FOAM SANDWICH IMPACT ATTENUATOR**

**(A) GENERAL.** Work under this item consists of furnishing, assembling and installing Hex-Foam impact attenuators in the size specified in the contract specifications, complete and in place as detailed and at the locations shown on the contract drawings as per the manufacturer's specifications.

**(B) MATERIALS.** The sandwich system shall consist of crushable Hex-Foam cartridges placed between rigid steel diaphragms in a multi-layered sandwich construction. The nose of the unit shall be protected with a flexible belting material and the sides shall be protected by fender panels. The unit shall be solidly anchored at the front and rear to stabilize the unit during impact.

**(1) Hex-Foam Cartridges** - The Hex-Foam material shall consist of paper honeycomb material placed in an alternating cross-ply orientation with polyurethane foam filling the honeycomb volume. The material shall be placed inside a plastic bag and woven containment bag and be enclosed in a weather-resistant plastic box.

**(2) Diaphragms** - The diaphragms shall be fabricated from 10 gauge, triple corrugated steel beam structural tubing. They shall be supported with two vertical legs which have ski-shaped plates welded to the bottom.

**(3) Fender Panels** - The fender panels shall be of sufficient strength to resist vehicle impact and perform as required with the unit. They shall be encased entirely in fiberglass which has a low coefficient of friction, a penetration resistant surface and is yellow in color.

**(4) Safety-Flex Belt** - Nose sections of sandwich units shall have a yellow safety flex belt wrapped around the front. The belt shall be made from 5/16 +1/16 flexible polyvinyl chloride material combined with synthetic fiber reinforcement. The belt shall be 32 inches high, cut to provide proper cable clearance and shall be fastened securely to the fender panels with 1/2 inch carriage bolts.

**(5) Metalwork** - All metalwork shall be fabricated from either M1020 Merchant Quality or AASHTO M 183 steel. After fabrication, all metalwork shall be hot dip galvanized in accordance with AASHTO M 111 or AASHTO M 232. All welding shall be performed by, or under the direction of a certified welder.

**(6) Wire Rope** - The two 7/8 inch wire ropes

**(7) Fasteners** - All bolts used in the unit shall be American Standard Regular Bolts.

**(C) CONSTRUCTION REQUIREMENTS.** Installation of the attenuators shall be performed by the Contractor with experienced workers in accordance with the procedures and recommendations of the manufacturer. Site preparation shall be done in accordance with the details shown on the contract plans.

**(D) MEASURE AND PAYMENT.** The unit of measure for these items shall be per each unit, complete and in place. Payment for HEX-FOAM IMPACT ATTENUATOR will be made at the contract unit price per each, which payment will include furnishing, assembling and installing the units and all labor, tools, materials, equipment and incidentals needed to complete the required work.